[redacted] STATINTL

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MEMORANDUM

To:

From: [redacted] STATINTL

Subject: Microdensitometer Evaluation Tests, Project Microcap

CC: [redacted] STATINTL

A set of tests have been developed for use in determining the operating and performance characteristics of recording microdensitometers. It is anticipated that these tests will be used to evaluate and classify the several models of recording microdensitometers presently available (see memo in preparation by [redacted] STATINTL STATINTL

The tests are intended to determine the instruments: 1) sine wave response, 2) sensitivity, 3) linearity, 4) mensuration accuracy and 5) recorder response time. In addition, various operator convenience characteristics such as the ease with which samples can be loaded and targets aligned will be noted as the tests are performed. A description of each of the tests follows.

Sine Wave Response

A set of test edges have been produced which have an edge width of less than one micron. These edges will be scanned using the various combinations of optics available with each instrument. Several of these edges will be placed in various positions in the sample format to measure the capability of the instrument to maintain focus across the scan format. The data obtained from the edge traces will be processed using the computer program written during this project to obtain the line spread and transfer functions of the microdensitometer system.

To provide some validation of the system transfer function obtained from the edge trace, a series of sine wave test patterns, produced under Project Microcap, with frequencies of 100, 200 and 400 cycles per millimeter and known modulation will also be scanned using each of the instruments.

Sensitivity

The definition of sensitivity quoted by most microdensitometer manufacturers is the minimum effective aperture area which allows a full scale response of the instrument-recorder combination. This value of sensitivity will be determined for each of the microdensitometers but will be extended to include a determination of the maximum density difference which can be measured with effective aperture areas less than that quoted by the manufacturer, down to that for the smallest effective aperture area which can be obtained with each instrument. This will provide information on the response of the instrument when used with various effective aperture areas below the minimum value quoted by the manufacturer and will also allow comparison of instruments with different maximum density ranges. The maximum density will be defined, for these tests, as that density at which the noise due to the electronic and mechanical components of the system does not cause fluctuations in the density trace which exceed the density accuracy quoted by the manufacturer.

In addition, the uniformity of area sensitivity of the phototube and the uniformity of illumination across the scanning aperture will be determined by recording the densities obtained with the various apertures available, zeroing the instrument with the largest area aperture, and determining the transmittance ratios for the various apertures. If the sensitivity of the phototube and the illumination of the scanning aperture are uniform, these transmittance ratios will be equal to the geometric area ratios of the apertures.

Linearity

The linearity of the response of the instrument will be obtained by, after a standard calibration of each instrument according to the manufacturers procedure, scanning a small density difference at various density levels. A density difference of approximately 0.1 will be used, and the density levels changed by placing various neutral density filters in the system. Any departure from the known density difference will provide a measure of the departure of the system response from linearity.

Mensuration Accuracy

While it is felt that the accuracy claimed by the manufacturers for the scanning stage drive mechanism will be as quoted, a simple test will be conducted to

verify the claims. A series of co-linear points with various arbitrary separations will be scanned starting and ending at different points. The sum of the distances determined between intermediate points by separate scans will be compared to the total distance between extreme points as determined by a single scan. This test will provide a check on the mensuration accuracy of the instrument, pointing out any excessive free play or backlash in the drive mechanism.

Recorder Response Time

The recorder response time will be determined by scanning one of the test edges at increasing scan speeds until the minimum rise time, as indicated by the time required to scan across the edge, is determined.

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